

REMARKS

The Office Action of September 5, 2007, is discussed in detail below.

Amendments to the Claims

Applicant has amended independent claims 1, 20, 30, 41, and 47 to recite that the conductive layer formed on first sidewall is electrically isolated from the conductive layer formed on a second sidewall. Support for these amendments may be found, for example, in Figures 1 and 2 of Applicant's specification.

Claim Rejections – 35 USC §103**From Paragraph 4 of the Office Action:**

Claims 1, 7 - 9, 16 - 23, 25 - 26, 29 - 33, 35 - 36, 39 - 53, 58 - 75, and 88 - 97 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagashima (US 5,312,773) in view of Harshfield (US 6,031,287).

The examiner maintains that Nagashima discloses a method of making a an electrical contact element that includes: providing a first dielectric layer 34, the first dielectric layer 34 having an opening, the opening having a sidewall surface and a bottom surface; forming a conductive layer (42,44) on the sidewall surface and on a portion of the bottom surface of the opening, the portion being less than the entire bottom surface (Fig.3); forming a second dielectric layer 46 (column 4, lines 3-7) on the conductive layer (42, 44), the second dielectric layer 46 contacting the bottom surface of the opening (Fig. 4); and forming upper level wiring conductor 50 in electrical communication with the conductive layer (42,44).

U.S. Patent 5,312,773 to Nagashima discloses, as the title implies, a method of making a multilayer interconnection structure. Such a structure, commonly referred to as a "via," is to be distinguished from the "electrical contact element" asserted by the examiner. Vias such as Nagashima discloses are commonly used for interconnecting a conductor on one level of an integrated circuit with a conductor on another level of an integrated circuit. As Nagashima notes, an object of his invention is to "provide an improved method of forming a multilayer interconnection structure, in which Si and polysilicon in the through-hole are not eroded and in which contact resistance is decreased." (column 2, lines 26-30, emphasis added) The structure and method of forming thereof disclosed by Nagashima is directed to reducing the resistance

between conductors, which is perfectly consistent with the purpose of an interconnection structure. Nagashima's conductive layer is formed on the sidewall of a through-hole (see, for example, Nagashima's abstract, column 2, line 29, column 2 line 40, column 2, line 44 and column 2 line 65). As such, the entire conductive layer on the through-hole's sidewall is in contact with both the first conductive layer 32 and second conductive layer 36; this configuration ensures low contact resistance between the first and second conductive layers, which are to be interconnected by Nagashima's interconnection structure.

As the applicant's amended claims now more particularly point out and distinctly claim, portions of the applicant's conductive layer formed on first and second sidewalls are electrically isolated one from the other; which is not the case for Nagashima's structure. Nagashima teaches a low-contact-resistance structure, one which does not include any voids in the conductive layer. The applicants claim a structure that includes voids which electrically isolate a portion of the conductive layer formed on one sidewall from another portion of the conductive layer formed on another sidewall. Additionally, not only does Nagashima fail to teach a programmable resistance material, phase-change material, or chalcogenide material in electrical communication with the conductive layer, he teaches away from the use of such material by virtue of his disclosed structure and his avowed purpose of creating a low-contact-resistance structure, which is inconsistent with the use of programmable resistance or phase change material. Nagashima, then, teaches away from the applicant's claimed invention in a number of ways.

The examiner maintains that U.S. Patent 6,031,287 to Harshfield ("Harshfield") teaches the forming of a phase-change programmable resistance material of chalcogenide as an upper level wiring conductor in electrical communication with a lower level wiring conductor through a conductive layer and that it would have been obvious to modify the method of Nagashima by

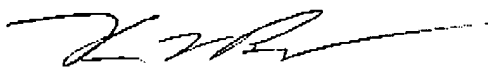
forming the upper level wiring conductor with a phase-change programmable resistance material because such a forming of the phase-change programmable resistance material for the upper level wiring conductor would provide a memory cell for a programmable memory device.

As noted above, Nagashima teaches away from the applicants claimed invention. Combining Nagashima is not only inappropriate, but, because of Nagashima's teaching away, the combination does not yield the applicant's claimed invention. As previously noted, all independent claims and, therefore all the applicant's claimed invention includes the limitation of electrically isolated portions of a conductive layer formed sidewalls of an opening. Both Harshfield (bottom portion of a the conductive layer) and Nagashima (continuous conductive layer on interior surface of through-hole) disclose structures without electrically -isolated portions of a conductive layer formed on sidewalls. Additionally, Nagashima, with his requirement for low-resistance interconnect, teaches away from the use of programmable resistance material.

SUMMARY

The remaining claims in the application are claims 1, 7 - 9, 16 - 23, 25 - 26, 29 - 33, 35 - 36, 39 - 53, 58 - 75, and 88 - 97. In view of the above amendment and argument, Applicant believes that the rejections of these claims have now been overcome and that these claims stand in a condition for allowance. Applicant respectfully requests withdrawal of all outstanding rejections and respectfully submits that the application stands in condition for allowance. If the Examiner has any questions or suggestions regarding this amendment, the Examiner is respectfully asked to contact Applicant's representative at the telephone number or email address listed below.

Respectfully submitted,



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